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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/305,019	05/04/1999	WIESLAW J. ROTH	10151-1	1528
23455	7590	06-02/2004	EXAMINER	
EXXONMOBIL CHEMICAL COMPANY			NGUYEN, TAM M	
P O BOX 2149			ART UNIT	PAPER NUMBER
BAYTOWN, TX 77522-2149			1764	

DATE MAILED: 06/02/2004

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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Paper No. 20040526

Application Number: 09/305,019  
Filing Date: May 04, 1999  
Appellant(s): ROTH ET AL.

Linda A. Kubena  
For Appellant

**EXAMINER'S ANSWER**

**MAILED**

**JUN 02 2004**

**GROUP 1700**

This is in response to the appeal brief filed May 13, 2004.

**(1) *Real Party in Interest***

A statement identifying the real party in interest is contained in the brief.

**(2) *Related Appeals and Interferences***

The brief does not contain a statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the

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pending appeal is contained in the brief. Therefore, it is presumed that there are none. The Board, however, may exercise its discretion to require an explicit statement as to the existence of any related appeals and interferences.

**(3) *Status of Claims***

The statement of the status of the claims contained in the brief is correct.

**(4) *Status of Amendments After Final***

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) *Summary of Invention***

The summary of invention contained in the brief is correct.

**(6) *Issues***

The appellant's statement of the issues in the brief is correct.

**(7) *Grouping of Claims***

Appellant's brief includes a statement that claims 4-9 stand or fall together, claims 11-12 stand or fall together, and claim 10 stands alone and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

**(8) *Claims Appealed***

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(9) *Prior Art of Record***

5557024

CHENG ET AL.

9-1996

EP-0733608

KUCHENMEISTER ET AL.

9-1996

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**(10) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 4-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng et al. (5,557,024) in view of Kuchenmeister et al. (EP 0733608)

Cheng discloses alkylation and transalkylation processes in which a feed containing an aromatic compound (e.g., benzene) and olefins (e.g., ethylene) is contacted with MCM-56 or beta zeolite catalyst in an alkylation zone to produce monoalkylbenzene products such as ethylbenzene. By-products (e.g., polyalkylbenzene), which are produced in the alkylation step, can be recycled to the alkylation reactor to undergo transalkylation or they can be reacted with additional aromatic feed in a separate reactor in the presence of TEA mordenite catalyst to produce monoalkylbenzene products. Cheng discloses reaction conditions for the alkylation step wherein the reaction takes place under liquid phase conditions at temperatures between 150 and 260° C and pressures up to 3000 psig in a space velocity of from 0.01 to 20 WHSV, based on ethylene feed. Cheng also indicates that the ratios of benzene to ethylene in the alkylation reactor may be from 1:1 to 30:1 molar. Cheng further discloses that the transalkylation zone is operated in a stoichiometric excess of aromatic compounds. Therefore, the ratio of benzene to polyalkylbenzene is greater than one. (See col. 3, lines 25-27; col. 5, lines 19-25; col. 6, lines 1-3; col. 12, line 10 through col. 14, line 40)

Kuchenmeister discloses a transalkylation process of polyalkylbenzenes (e.g., polyethylbenzene) which are produced during the alkylation of benzene with olefins (e.g., ethylene) by using a crystalline aluminosilicate catalyst having an average size of less than about 0.50  $\mu\text{m}$ . The alkylation and the transalkylation processes are conducted at a temperature

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between 250<sup>0</sup> C and 500<sup>0</sup> C, a pressure between 200 psi and 500 psi (1390 - 3447 kPa), at a WHSV from about 20 to 150 hr<sup>-1</sup>, and a feeding ratio of benzene to ethylene from about 2:1 to 20:1. The reference discloses that the transalkylation process can be operated in a separate reactor, but it is preferred to recycle the polyalkylbenzenes to the transalkylation reactor. (See page 2 through page 3)

Regarding claim 4, Cheng does not disclose that the mordenite catalyst has an average crystal size of less than 0.5 micron. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Cheng to utilize a TEA-mordenite catalyst having an average crystal size of less than 0.5 micron given Kuchenmeister's teaching that improved transalkylation control in the production of ethylbenzene is attributable "to the use of an aluminosilicate catalyst having a crystal size less than 0.5 microns". (See Kuchenmeister, page 3, lines 29-30).

Claim 10 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claim 4 above, and further in view of Innes et al. (4,891,458).

All of the references above do not disclose the claimed transalkylation operating pressure and the weight ratio of benzene to polyalkylated benzene.

Innes discloses a transalkylation process of polyalkylbenzene and an aromatic compound (e.g., benzene) in which the transalkylation process is operated at a pressure of 50 psig to 100 psig (344 -6894 kPa) to maintain the process in the liquid phase. The reference also discloses that the molar ratio of aromatic hydrocarbon to polyalkylated aromatic hydrocarbon ranges from about 1:1 to about 50:1. This ratio appears to be within the range of the claimed weight ratio. (See col. 5, lines 43-54)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the Kuchenmeister/Cheng process by operating the transalkylation process at the pressure and the molar ratio of aromatic hydrocarbon to polyalkylated aromatic hydrocarbon as taught by Innes because the Innes pressure will maintain the process in the liquid phase and the Innes ratio is effective for a transalkylation process of an aromatic hydrocarbon with a polyalkylated aromatic hydrocarbon.

Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cheng et al. (5,557,024) in view of Kuchenmeister et al. (EP 0733608) and Chu (3,766,093).

Cheng does not specifically disclose that the TEA mordenite has a  $\text{Si}/\text{Al}_2$  molar ratio of less than 90 or between 35 and 50. However, Chu discloses a mordenite catalyst having a  $\text{SiO}_2/\text{Al}_2\text{O}_3$  molar ratio of 20-100 ( $\text{Si}/\text{Al}_2 = 10-50$ ). See col. 8, line 73 through col. 9, line 18. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Cheng by using a TEA mordenite having a molar ratio of  $\text{Si}/\text{Al}_2$  of from 10-50 because Chen discloses that the TEA mordenite can be prepared by the Chu process. (See Chen col. 14, lines 34-39)

**(11) Response to Argument**

The argument that there is no motivation to combine the teachings of Kuchenmeister et al. with those of Cheng et al. to arrive at the claimed invention is not persuasive. One of skill in the art would utilize a catalyst having an average size of less than about  $0.50 \mu\text{m}$  as taught by Kuchenmeister because a catalyst having such size would improve transalkylation control in the production of ethylbenzene is attributable (See Kuchenmeister, page 3, lines 29-30).

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The argument that Cheng does not set forth the particle size of their transalkylation catalyst and does not indicate any preference for the use of a TEA-mordenite is not persuasive. Cheng discloses that a TEA mordenite catalyst can be used in the process (see col. 14, lines 30-36). Since one of skill in the art would use a catalyst having any size in the process of Cheng and given the teaching of Kuchenmeister, one of skill in the art would use a catalyst having an average size of less than about  $0.50\ \mu\text{m}$  because of its benefits.

The argument that the teaching of Kuchenmeister is misconstrued by examiner is not persuasive. As a whole, Kuchenmeister teaches that it is advantageous to use a crystalline aluminosilicate catalyst having an average size of less than about  $0.50\ \mu\text{m}$  in an alkylation process.

The argument that, according to page 2, lines 25-28 and page 3, lines 19-20 of Kuchenmeister, the catalyst of Kuchenmeister would not be expected to perform similarly under liquid conditions as it does under vapor conditions is not persuasive. The examiner does not find that the teaching in pages 2 and 3 of Kuchenmeister indicates that the catalyst would not be operable under liquid conditions. The examiner, however, acknowledges that at such wide ranges of operating temperatures and pressures (a temperature of from  $250\text{-}500^\circ\text{C}$  and at a pressure of from about  $200\text{-}500\ \text{psi}$ ), it would be expected that the catalyst would be effective to operate under either liquid or vapor conditions depending on the type of feedstock. Moreover, Cheng does not limit the size of the **crystalline aluminosilicate** catalyst (e.g. TEA-mordenite and zeolites) and discloses that the alkylation can be operated under either liquid or vapor conditions. Given this teaching of Cheng, one would learn that in an alkylation process using a crystalline aluminosilicate catalyst, the size of the crystalline aluminosilicate catalyst does not affect the

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operating conditions (vapor or liquid). Therefore, one of skill in the art would use the Kuchenmeister catalyst in the process of Cheng under either liquid or vapor conditions. It is reminded that both the Cheng catalyst and the Kuchenmeister catalyst are a **crystalline aluminosilicate** catalyst.

The argument that there are a multitude of aluminosilicate catalysts and Kuchenmeister does not provide any enabling direction as to how to synthesize the described catalyst is not persuasive. It appears that any crystalline aluminosilicate having an average size of less than about 0.50  $\mu\text{m}$  can be used in the alkylation process of Kuchenmeister. Also, Chen discloses that it is known to use a crystalline aluminosilicate catalyst such as TEA mordenite in an alkylation process (see col. 14, lines 27-36).

The argument that the catalyst of Kuchenmeister contains up to **about** 40 % orthorhombic crystalline structure while a TEA mordenite catalyst has an upper limit of 40 % is not persuasive because the amount of orthorhombic crystalline structure of the Kuchenmeister catalyst overlaps the amount of orthorhombic crystalline structure of TEA mordenite.

The argument that the declaration filed by Dr. Wieslaw Roth showed unexpected results when using the claimed catalyst is noted. The argument is not persuasive because the three mordenite-catalysts in table 1 in the declaration are different in silica/alumina ratio, alpha value and surface area. Therefore, it is unclear if the aging rate or other benefits are dependent on silica/alumina ratio, alpha value, surface area, or a combination thereof. For this reason, the existence of unexpected results cannot be determined. Since the modified catalyst of Cheng/Kuchenmeister is essentially the same as the claimed catalyst, it would be expected that



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the catalyst of Cheng/Kuchenmeister would provide similar results as disclosed in the declaration.

The argument that the second declaration showed that the claimed TEA-mordenite with a crystal size of **less than** 0.5 micron is better than the 0.5 micron crystal size catalyst of Kuchenmeister is not persuasive. Kuchenmeister discloses that the catalyst has an average crystal size of about less than 0.5 micron as claimed. Also, as discussed above, the crystalline aluminosilicate catalyst of Kuchenmeister would include TEA-mordenite. Therefore, the comparability of the two catalysts is invalid.

The argument that when combining the Cheng, Kuchenmeister and Innes references, one would use beta zeolite in the process of Cheng is not persuasive because the examiner relied upon Innes to teach that the Innes conditions are effective to keep the alkylation process under liquid conditions.

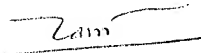
The argument that it is difficult if not impossible to use the Chu mordenite while having a Si/Al<sub>2</sub> molar ratio of less than 90 which has a crystal size less than 5 microns is not persuasive. Cheng does not limit the molar ratio of Si/Al<sub>2</sub> or the size of the catalyst which can be prepared by Chu who discloses that it is conventional to use a TEA-mordenite catalyst having the claimed ratio of Si/Al<sub>2</sub> whereas Kuchenmeister discloses the success of using a crystalline aluminosilicate catalyst having an average size of less than 0.5 micron. One of skill would employ the teachings of Kuchenmeister and Chu in the process of Cheng.

For the above reasons, it is believed that the rejections should be sustained.

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Respectfully submitted,

Tam M. Nguyen  
Examiner  
Art Unit 1764



TN

May 31, 2004

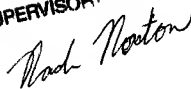
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